Center for Independent Experts (CIE) Peer Review Report of: Joint US-Canada Technical Review Panel for the Pacific Hake/Whiting Stock Assessment

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E J Simmonds

1. Executive Summary

The U.S. and Canada are forming a new agreement which formalizes past scientific and stock assessment collaboration through the creation of two new scientific bodies: a Joint Technical Committee, charged with producing an annual stock assessment, and a Scientific Review Group (SRG) to provide peer review of the technical committee's work. The first meeting of this group convened in Seattle, Washington, to evaluate the assessment.

In addition to those involved from US and Canada, the meeting was attended by two independent Center for Independent Experts (CIE) reviewers, of which this report is from one of those reviewers.

The reports and presentations have provided an excellent basis to evaluate the performance of the assessment. There was unanimous agreement that the survey and assessment reports and presentations have provided an excellent basis to evaluate the performance of the assessment. The science reviewed was of a high standard and could be classed as 'of the best scientific information available'.

The conclusions are that the survey provides information that is well suited for the assessment, though some improvements are possible. In particular, studies to extend the variance estimation would be helpful to increase the understanding of the survey and its utility in the assessment model. Given the biennial frequency of the survey and the highly variable recruitment, the current assessment is prone to major revisions which can cause unhelpful fluctuations in the yield estimates. Annual surveys should much reduce these problems.

The assessment model has full utility for management purposes, and should be used to give management advice. Some minor checks on the implications of the separable assumption would enhance the understanding of the performance of the model.

It is considered that there would be considerable advantages in developing a Management Strategy Evaluation for this stock, both to evaluate alternative lower fluctuating harvest rules and to evaluate the utility of alternative survey strategies.

2. Background

The U.S. and Canada are in the process of implementing the U.S.-Canada Agreement on Pacific hake and Whiting. This new agreement formalizes past scientific and stock assessment collaboration through the creation of two new scientific bodies: a Joint Technical Committee, charged with producing an annual stock assessment, and a Scientific Review Group, to provide peer review of the technical committee's work. These groups will include scientists appointed by each Party, as well as independent members referred by the Advisory Panel, a panel of private sector advisors. Another

body, the Joint Management Committee, will consider the scientific advice and recommend to the Parties each year an overall total allowable catch.

Two independent reviewers are requested to participate in the Scientific Review Group meeting. The Agreement calls for the SRG to be comprised of up to six scientific experts, with two jointly appointed by each Party (U.S. and Canada) and two independent members appointed jointly by the Parties from a list supplied by the Advisory Panel. At this point in time, not all members of the SRG committee have been formally selected or appointed by the two Parties and therefore, participation of the CIE reviewers may vary.

The Center for Independent Experts (CIE) reviewers participated in the review panel meeting as "officially invited members" of the SRG rather than "formally appointed members", as outlined in the Pacific hake Agreement. CIE participation in official SRG discussions and decisions was at the discretion of the SRG co-chairs.

The Pacific hake (or whiting, *Merluccius productus*) benchmark stock assessment provides the basis for the management of the largest groundfish fisheries off the West Coast of the U.S. and British Columbia. For example, in 2010, Pacific whiting fishery accounted for 85% of the landed catch and 32% ex-vessel revenue of the U.S. Pacific coast groundfish fishery. The technical review took place during a formal, public, multiple-day meeting of fishery stock assessment experts. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

3. Description of the Reviewer's Role in the Review Activities

I am an expert in both Fisheries Acoustics and Stock Assessment and their use in fish stock management. My background is that of a senior fisheries scientist currently working European Commission dealing with management strategy evaluation (MSE) and Impact Assessment of fishery management plans. I obtained BSc. and MSc. degrees in Electronics and Underwater Acoustics in UK. Before recently joining the European Commission, I had worked in fisheries research for 37 years at the Government Fisheries Research Laboratory Aberdeen in Scotland. I have worked with acoustic surveys for more than 30 years and carried out stock assessments involving acoustic-trawl, trawl and egg surveys for more than 15 years. I am co-author of books on Fisheries Acoustics (1991 and 2nd Edition 2005) and Geostatistics (2000). In addition to work in Aberdeen, Scotland, I have been involved in acoustic-trawl surveys off Morocco, Ecuador, Peru, and in the Persian Gulf and the South China Sea. Since 1990 I have developed extensive experience of fish stock assessment and fisheries management, chairing among other groups the ICES herring survey planning group 1991-95, the ICES Fisheries Acoustics working group 1993-96, the ICES Herring Assessment working group 1998-2000, and the ICES study group on Management Strategies from 2004-2009. In addition to a wide range of assessment work as part of the ICES assessment process, I have been responsible for developing approaches for combining acoustic-trawl, trawl and ichthyoplankton surveys in assessments for North Sea herring, North East Atlantic mackerel, and Peruvian Anchoveta. I currently chair the European Commission STECF

group that prepares evaluations of historic performance of management plans and the impact assessments for new multi-annual fisheries management plans.

I participated in all aspects of the review, paying particular attention to acoustic survey design and analysis, calculations of total biomass and its variance, and the utility of the results as an index of abundance within the current SS3 assessment for Pacific hake.

The stock that is the subject of this review, *Merluccius productus*, has been described as Pacific hake and as Pacific whiting, throughout this report I have chosen to use the term hake as the simple species description for the stock.

4. Findings by ToR

The detailed ToR are provided in Appendix 2 Annex 2. The ToR contains a mixture of procedural and scientific review requirements. The review provided here is organized to provide a detailed summary of scientific aspects under ToR 1, review of methods (Section 4.2 input data and 4.3 assessment), ToR 10, suggestions for improvements (Section 4.4), and ToR 15 recommendations (Section 4.5). (The review of process is included as Section 4.6).

In addition to these ToR, the remaining aspects are summarized briefly here. ToR items 2-6 describe the procedures under which US and Canada should carry out the review; these appear to have been fully complied with during the meeting. ToR 7 regarding consensus was complied with, no vote was required and there were no substantive issues of dispute. The major differences were those of emphasis or importance of particular items, but there was no area with serious disagreement. ToR 8 dealing with documentation was fully complied with (Section 4.1). ToR 9 regarding information from the public was complied with, opportunities for public comment were provided on several occasions, some highly pertinent comments were made by fishing industry representatives and some of these directly affected the recommendations of the group. The SRG report, ToR 11 is currently under preparation but current drafts do contain the discussion. ToR 12 regarding additional requests in writing was complied with. ToR 13 and 14 involving a consensus model and yield advice was complied with, minor amendments were made to the assessment due to reported revision of the acoustic survey and new tables of yield and risk were produced during and after the meeting. A report has been prepared under ToR 16.

Throughout this report the species under discussion Pacific hake/whiting (*Merluccius productus*) is referred to as Pacific hake. This is a convenient shorthand and does not imply any preference for particular name.

4.1. Documentation for Pacific hake stock assessment(s) and background materials

The draft 2012 assessment report and background documents (see appendix 1) were circulated on 7 February, two weeks before the peer review. All documents were read by the reviewer in preparation for the peer review during the two weeks prior to the start date of the review. Several aspects of the assessment were considered and some of the input data sets provided in the 2012 draft report were inspected in detail. In preparation for the meeting analysis of mortality signals in acoustic survey and catch data were examined through log catch ratios. Comparisons of the relative selectivity in catch and survey were made by comparing the age structure of the catch in the age structure in the survey in survey years. Comparison of these mortality signals obtained outside the assessment framework indicated that the rise in mortality seen in the assessment was supported both by catch and survey data and that the catch and acoustic survey data are more in agreement with the current assessment than the previous '2011' assessment.

4.2. Evaluation of the quality of data used in the assessment

There are a number of aspects considered, specifically those items that are explicitly included in the modeling for current and historic stock status but also some items that are additional and might influence management.

4.2.1. Catch data

Catch at age appear relatively well sampled and for length weight and age with larger numbers of observations. Sampling for maturation / fecundity has been sporadic (see below). A number of aspects have been highlighted in the report, for particular attention: correct identification of age, and estimation of weight at age. The use of weights at age in the catch based directly on observations has been examined and is considered to be a pragmatic solution commonly used elsewhere particularly where both growth rates vary over space and time and fisheries are variable from year to year. The use of these weights in the assessment model as weights at age in the stock is less clear cut, but any additional variability or bias in weights at age at spawning time is a thought to be a minor issue.

The aging error may be one aspect of the assessment that may be introducing additional error in the modeling as there is some evidence of consistent deviation between observations of numbers at age in the catch and numbers at age in the population. It is unclear whether this is due to the assumption of a separable model with fixed selection or due to aging errors. Further work on aging errors would be helpful, but cannot be considered as the most important aspect in need of improvement.

For biological understanding, it would be helpful to collect more maturity data. The current data is sufficient to give a baseline but it is important to establish if this is typical. Variable maturity influences management in two ways: the locations of SSB observations on the x axis of the stock recruit plot which will in most cases have minor influence on stock recruit modeling; and secondly, estimation and prediction of current spawning stock size. Current proposals to collect more maturity data should be encouraged and

should be sustained for long enough to characterize maturity at age for small and large yearclasses.

4.2.2. Survey data

Currently, the survey data that appears to be most likely to deliver useful tuning indices is the acoustic survey. The current survey is designed to estimate 2+ hake. Aspects of the data collection and any analysis required before the data are used in the assessment model are discussed in detail in this section.
Dezhang Chu opened the meeting with a detailed presentation of the acoustic/trawl survey design, acoustic calibration technique, target verification trawl selection process, echogram scoring methodology, and biomass interpolation using kriging. The acoustic team is fully compliant with international best practices for acoustic trawl surveys with limited resources. Rebecca Thomas presented the 2011 survey results, which had been very slightly updated and set these results in the context of the survey timeseries.

4.2.2.1. Age 1 survey data

Some acoustic survey data on age 1 hake is collected but it is fairly clear that the survey area needs to be extended if indices of age 1 hake are to be obtained with sufficient reliability to be informative. In any survey year, such an index would be almost the only informative data at that age. Thus, the precision of the index will transfer directly to the precision of the estimate of any incoming yearclass in the assessment. Certainly, it is worth considering if a model based on the acoustic index alone or one based on combined noisy catch data and survey would be the most informative. In theory, if appropriate weighting factors can be found, a combined index (with more data) should be more reliable. ICES has a simple software procedure 'RCT3' (see ICES.dk software) that might be helpful in determining weight and utility for multiple and different sources of recruit indices. The procedure provides an analytical framework for estimating recruitment from several noisy time-series, assigning appropriate proportions of series mean and yearly current index(s) value.

4.2.2.1. Age 2+ survey data

The survey protocol was provided as part of the background documents (Appendix 1). It is not completely clear exactly how this protocol relates both to Canada and US but there is no indication that the design or analytical approach is inappropriate for either area. The protocols described follow widely accepted practice for acoustic surveys in other parts of the world (e.g. ICES 2011) and the team is fully competent to follow these protocols.

Equipment calibration data was requested by and provided to the review group during the meeting, this shows a fairly typical variability in calibration that might introduce / fail to detect changes of up to 5% in biomass estimates due to equipment performance. Both Canadian and US groups should ensure that calibrations are continued and reported annually as part of the reporting procedures to ensure that changes in equipment are documented. These are some shifts in equipment performance (of around 15%) that have been taken into account. Well maintained systems can exhibit changes of this order, but if

fluctuations at this level or continued trends are observed, it would be helpful to establish what might be the causes.

Use of Target Strength equation: Use of a TS - length equation is very common practice for acoustic surveys. Currently, the TS length equation is based on studies from many years ago. More recent studies (Henderson and Horne 2007) have indicated a different equation, though these studies are not necessarily directly applicable as the conditions for the measurements are not entirely in line with survey conditions. TS measurement would be helpful and improve confidence in the survey, or help to identify any errors, but is not critical. Both possible equations currently available have the same length dependence and because the survey is used an index of abundance revising the intercept will only change the Q in the assessment and have no impact on the results.

Transect designs are based around a parallel design with transect length adapted if necessary should observations continue to the end of the planned transect. This is a reasonable and pragmatic adaptive approach. Occasionally, vessel availability has resulted in increasing the transect spacing in parts of the area. It is important to ensure that if this happens, the analysis procedure (kriging) does not leave gaps in the estimates but gives estimates that cover a standard region.

The use of a random start to the overall survey grid design is formally important if the survey were to be used as an absolute estimate of abundance. Currently, the survey is used as an index so inclusion of this is of lower importance. However, for practical purposes the differences in results with and without this random start are expected to be negligible.

Currently, the transect design is close to uniform, based on an assumption of stationary variance within the area. If consistent areas with higher variability can be determined prior to the survey, there may be benefits in allocating more effort in these areas, or reducing the effort in lower variance areas. Practically this may mean increasing transect spacing in predictably low density areas (as low density is often linked to lower sill in the variogram and lower estimation variance). The parallel transect design is considered to be a minimum variance design where transect lengths exceed 2 times transect spacing, taking account of any anisotropy in the scaling of the area. For shorter transects less than 2 times the spacing zigzag estimation is thought to be optimal. A zigzag approach can cover the area more quickly (or with more transects with lower spacing) but the transects are more correlated at the transect ends and the tradeoff between spacing / correlation occurs very close to transects spacing of ½ of transect length (see Rivoirard et al. 2000, Simmonds and Fryer, 1996). For some of the Northern area change to zigzag transects might be helpful, but the differences will be marginal.

Acoustic sampling variance based on a geostatistical approach. This is a good approach allowing the current survey design based on systematically spaced transects to maximize the information collected in a correlated domain while allowing a variance that accounts for that correlation to be calculated. The geostatistical analysis confirms the presence of spatial autocorrelation. To estimate the variance using geostatistics it is necessary to

define the domain covered by the survey. Normally, the along shore dimension of the area covered would be a standardized area, extending on average ½ transect spacing to the north and south (or the area within which the random start is drawn). The definition of the boundary along the coast and on the offshore boundary needs some consideration. Currently, transects are extended if hake are observed at or close to the transect end this forms an adaptive approach. If it is considered that this adaptive approach can be regarded as more or less without error, then the variance should be calculated for an area bounded by the transect ends. If it is considered that hake biomass can be observed with some probability beyond the survey transects out to some overall limit the domain could be extended, though under these circumstances the variance estimate treats the unsurveyed area as having the same variability in abundance as the survey area. This seems unlikely to be the case and the variance would be an upper bound for the spatial sampling variance. All the evidence presented suggests that the geostatistical estimation variance indicates a rather precise estimate with low sampling variance. As the assessment model estimate of the precision of the index is substantially greater, this implies that other sources of variability not currently analyzed are dominating the precision of the survey.

Other sources of variance: Currently, spatial sampling variance of NASC is the only aspect explicitly evaluated. The survey group is well aware of other sources of variance and the need to characterize these in the future. These include:

- Estimation of hake size
- Estimation of hake TS (from size)
- Allocation of echosounder traces (or sign) to species category
- Estimation of species proportion for mixed aggregations
- Estimation of TS for other species in the mixtures

These analyses require non trivial resources and a variety of methods have been proposed to estimate them. See for example Simmonds (2009), Zwolinski et al. (2009), Woillez, et al. (2009), Petitgas et al. (2009). The group working on Alaskan walleye pollock has developed some approaches for this acoustic survey and close cooperation with this group might be fruitful.

Other analytical aspects: Currently kriging results are reported for 2+ biomass. Other aspects also need to be available spatially. In particular, hake size and proportion at age in space. The current method uses a post stratified area based selection based on a Kolmogerov/Smirnov test of similarity at length. This is a pragmatic approach which effectively fits a piecewise model of mean size around the area, partitioning some of the variability as process variability (spatial change in size) between selected areas and some as measurement error, within selected areas. Within this approach, size/age strata can be spatially fragmented. This is probably not a good idea and it might be better to increase the number of strata splitting any non-contiguous stratum into several self-contained strata. For the longer term approaches to multivariate mapping could be considered, for example Simard et al. (2003), who transformed size distributions to principle components with independent parameters that could be mapped separately. Only a small number of

significant independent parameters needed to be mapped. A reverse transform gave estimates of size distribution spatially. However, this not considered a high priority but might make an interesting research topic.

Overall survey variance. The fit of the 8 acoustic survey points to the assessment model indicates 5 points that fit very closely, two with poor fit and one (the most recent) of unknown properties. One can consider two possibilities, the errors are homogeneous, and the five close fits and two poor ones have occurred by chance, or alternatively there may be different process involved in different surveys. The precision of the sampling on the NASC and the high degree of spatial homogeneity on hake size are more compatible with the 5 close fitting values suggesting that there may be additional intermittent sources of uncertainty, such as the issue with Humbolt squid reported and analyzed in 2009. In order to make progress in this area it might be helpful to hypothesize what mechanisms could be responsible for the deviations in the two poorest years. Then to evaluate what could be done to test for aspects with sufficient magnitude to give these deviations.

Conclusions to the acoustic survey. The technical competence of the group working on the acoustic surveys is at a high level. The current approaches are delivering useful estimates that can inform the assessment model and without these the assessment model would not useful for management. The current analysis approach is able to make reasonable estimates from the data collected. There is a need to first to extend the variance estimation methodology.

4.3. Evaluation of assessment model structure, assumptions and estimates

Following the acoustic survey presentation and on the second day of the meeting, Ian Stewart, Nathan Taylor, and Allan Hicks presented the input data model structure results and sensitivity analysis. This was a well structured presentation and the group should be commended on their work.

4.3.1. Model structure

Two assessment models have been developed over recent years and both follow a fairly standard basic structure of a statistical catch at age model tuned with survey biomass and proportion at age data. The major assumptions are:

- An estimated age dependent Q for the 2+ acoustic survey
- A separable catch at age model with a single separable period 1975-2011

Both selection patterns are asymptotic above a predefined age.

A great deal of work has gone into the selection of these modeling approaches and when both assessment models are now set up with similar parameterization they give very comparable results. Together, they have provided validation of the code and

complimentary exploration capability. The setup of the two models requires a high degree of technical expertise which is clearly evident in the assessment group. The assessment report provides good documentation for the base case and an extensive range of sensitivity tests.

In particular, selectivity assumptions were explored using SS and CCAM models. The use of estimated / fixed survey selectivity in the CCAM model and increasing or decreasing the age of asymptotic selectivity by one year in SS model. The results from these sensitivity tests suggest dependence on these variables but well within the range of uncertainty exhibited by the base case. This was very supportive of the base case model.

The main conclusions of the assessment are that the major source of uncertainty for managers comes from the most recent acoustic survey estimates, though estimation of the unexploited reference level also introduces some uncertainty in the perception of stock status. The model appears to be useful for management purposes, though the high level of uncertainty around the estimate may need to be considered more explicitly in management. There are a number of considerations, leading to other sensitivity tests and suggestions for work discussed below.

Separable assumption in the fishery:
The report describes variability in the distribution of hake:

> *The distribution of Pacific hake can vary greatly between years. It appears that northward migration patterns are related to the strength of subsurface flow of the California Current and upwelling conditions.*

Generally, older fish are found towards the north and younger fish more inshore and to the south. The variability leads to different age and size of hake availability in different regions. In discussion of the use of commercial CPU indices, the following excellent description of fleet behaviour is provided:

> *Factory trawlers may continue to fish the same aggregation for days, while shore-based sectors may be balancing running time with hold capacity and therefore opt for differing catch rates. Further, during the last decade, the hake fishery has been severely constrained in some areas due to avoidance of rockfish bycatch. Periodic voluntary 'stand-downs', and temporary in-season closures have resulted from high bycatch rates, and in some years fishermen have changed their fishing behavior and fishing areas, in order to reduce bycatch of overfished rockfish species. Furthermore, the US at-sea fleet generally leaves the hake fishing grounds for a period during the season to participate in the Bering Sea pollock fishery. It is unlikely that such fleet dynamics and inter-species effects can be dealt with adequately in order to produce a reliable index for Pacific hake based on fishery CPUE data.*

In addition, the catch allocation to US and Canada are broadly fixed but the recruitment is episodic, thus fixed national proportions are taken from different spatially separated age groups.

Taken together these four factors; episodic recruitment, variable spatial distribution, fixed national allocations and varying fleet behaviour don't support well a separable model for the fishery.

Examination of catch by fleet over recent years shows changes in proportion of catch by fleet segment, by month and by latitude. Examination of residual patterns with respect to the separable models show patchiness over time and age, but in particular there are many cohorts which exhibit long sequences of either positive or negative residuals. Over the recent year the JTC have recognised this lack of fit and made efforts to determine if more variable selection can give improved modelling. The historic approaches described in the reports involve blocking of years into different separable periods or more flexible separable models. However, the type of residual pattern observed is not amenable to modelling with block changes or trends in selection. Rather the issue is adjacent cohorts are showing different patterns. Such effects are not easily dealt with by separable models of any normal kind. In addition, the stock magnitude is driven by only one or two cohorts at a time, so successive residuals can lead to substantial successive under or overestimation. The JTC have concluded that a single separable model is as good as any other method, implying that all residuals represent measurement error around a rigid exploitation pattern. This is a pragmatic approach but is not entirely satisfactory. This kind of problem has been encountered by other assessment groups. For example, the assessment of Norwegian Spring Spawning herring (the largest herring stock in the world) has many comparable features, with highly variable recruitment with yearclasses appearing to join the fishery at different ages and exhibiting different exploitation from cohorts in adjacent years. Norwegian Spring Spawning herring exhibit different seasonal behaviour by cohort, remaining in the Barents Sea to different ages. Migrations of adults vary by year and by cohort, where some cohorts have overwintered in fjords, some have remained more off shore. Like Pacific hake, the Norwegian spring spawning herring is a well sampled fishery with well estimated catch, so errors in catch estimation (excepting aging errors) are not expected to be great and variability is expected to be the norm.

For a number of years, the Norwegian Spring spawning stock assessment was done by modelling exploitation only of large cohorts trying to fit selection along these and interpolating with a limited penalty function on the less abundant and largely negligible adjacent yearclasses (ICES 2001b and Røttingen and Tjelmeland 2003). This modelling approach resulted in less obvious patterning in along cohort residuals but was still prone to substantial yearly revision. Having struggled with this for a number of years more recently, the approach has been to treat the fishery data as a variable process, without measurement error by fitting a VPA using age based survey data to obtain the terminal Ns (ICES 2011. Report of the Working Group on Widely distributed stocks WGWIDE: ICES CM 2011/ACOM:15). This has increased the stability in the assessment but the important disadvantage of this approach is that there is no error distribution to use in simulation or to calculate the precision of the exploitation. Thus such an approach raises

other issues. Nevertheless, it is fairly clear that the current separable model for Pacific hake is not well supported by our knowledge of the fishery.

All the model sensitivity tests that have been carried out are conditional on this type of separable assumption. Yet when we consider the fit to the Acoustic survey, the pattern of residuals is far from ideal. It might be helpful to see if the separable assumption is part of this mismatch. So it would be useful to test if the alternative extreme (no measurement error and all process variability in the fishery, compared with all measurement error and no variability fishery) gives a different perception of the residual patterns with the acoustic survey index. If the residual pattern were to be largely unaffected this would be very supportive of the current approach; however, if the fit through the three most recent acoustic biomass estimates were to be different this would indicate if the separability assumption might be of concern. 'Going back to a VPA' appears regressive and is not scientifically popular. Such a diagnostic is not hard to implement. In my view this would be a worthwhile sensitivity check, though I acknowledge the view was not well supported by others.

Steepness in S-R relationship
Currently, the steepness in the Beverton Holt S-R model depends on a prior based on Myers et al. (1999); the JTC considers that "*the prior distributions steepness are likely strongly influencing the posterior*". The sensitivity tests evaluate the influence of precision, and the mean of the functional relationship, but the weight of a prior in the model is difficult to control and appears from the posterior to be very important. There is some weak evidence for steepness within the assessment estimates of S-R and this would weakly support a S-R function without a strongly informative prior. In order to take account of the current assessment and updated assessments of other hake populations and any other populations considered comparable, it might be better to change the way this is approached. I suggest putting an updated data set of S-R pairs from other stocks in as observations into this assessment model. As the report indicates this is an important parameter for management, and this might be a way to take account of 'internal' and 'external' values of S-R more clearly. Care would need to be taken to account correctly for the influence of different natural mortality values used in some of the other assessments, particularly where the assessments have different minimum age. (This aspect was not raised during the discussions but given the importance of the parameter is probably worth consideration).

4.4. Quality of scientific information available and suggestions

4.4.1. Specific recommendations regarding input to the assessment

Consider increasing the frequency of acoustic survey to annual surveys. The acoustic survey provides the most important data series to estimating biomass dynamics in the stock. However, the survey's impact on the assessment is driven by the last year's estimate (and the mean of the series), making the management advice particularly sensitive to years with large residuals. With the survey being conducted only in odd years

it can take two years to correct for a large error. This limitation is especially pertinent because the stock and fishery rely on intermittent high recruitment, and such recruitment will be detected by the acoustic survey when fish reach age 2 or 3, in alternate years, by which time they are already an important part of the fishery. It is recommended that the survey be made annually, which would improve management's ability to smooth the errors and react appropriately to both strong and weak recruitments. This could be evaluated through an MSE (management strategy evaluation) (see below).

Inter-vessel calibrations. Standard sphere calibrations of acoustics gear are performed regularly on vessels conducting the survey; however, potential differences among vessels have not yet been quantified fully. There are some, though poorly founded, indications of possible vessel difference between Canadian and US vessels. I recommend periodic inter-vessel calibrations. This is an important aspect of verification of survey stability and quality control in this assessment. It is a very good way to increase user confidence in the survey.

An Age-1 index of abundance of young hake could inform stock assessments to high or low recruitment events. Preliminary research has already been done on the potential of obtaining an index through acoustics or through extension of present trawl surveys. The acoustic survey could be extended with minor reallocation of time to cover the age 1 hake.

There is some doubt about the identification of echosounder traces (sign) to species. It would be helpful to evaluate increasing the number of target verification tows to reduce uncertainty in assigning species and or demographic characteristics to backscatter (it was noted this could potentially be done in collaboration with industry). In addition, the fishing gear does not catch hake and myctophids with equal selectivity. There is a possibility that this could cause errors in the survey that would give rise to year specific residuals. Two approaches are possible; a) the use of gear attachments to measure mesh escapement of mytophids (and hake) and b) the use of acoustic broadband systems to indicate if significant backscatter could be coming from myctophids. A number of approached have been developed. The general philosophy is well described in McClatchie et al. (2000), some analytical approaches developed by O'Driscoll (2003) and some automated approaches to the allocation of traces through statistical methods based on the observed shape properties Fernandes (2009), and frequency dependence Korneliussen and Ona (2009).

The JTC/acoustic group needs to explore acoustic selectivity at age further. The current selection at age estimated in the assessment model suggests substantial underestimation of age 2 hake in the acoustic survey, it would be helpful to identify the reason for this.

The Acoustic team should generate a list of hypotheses that could explain the high acoustic biomass index observed in 2009. It should identify if research studies could be proposed to detect if any hypothesis can be rejected, and it should evaluate if further data would be needed to detect/evaluate hypotheses if they were to occur on future surveys. If so, it should arrange for this data to be collected.

Based on comments from an industry participant there is some concern that the acoustic survey may be missing some biomass to the (north) western edge of the survey grid. It was reported that substantial successful fishing has taken place over the last five years seaward of the deep extent of the acoustic transects in Canadian waters. Some additional work to explore the seaward extent of hake distribution would be helpful. It may be that industry boats with high quality sounders could help with this exploration. It was also suggested that there may be opportunities for industry to collect acoustic backscatter data (with their own sounders) that might be used to improve our understanding of hake distribution and abundance. It was noted by the SRG that the benefits of such a project would need to be evaluated beforehand and a scientific protocol developed to ensure consistent data collection by participants.

Life-history data improvements. Present information on maturity at age is from a single study in the 1990s. It is recommended that regular collection and analysis of life-history data such as growth, fecundity, and maturity at age be undertaken, rather than relying on static values from the literature.

4.4.2. Specific Modeling aspects

The base-case assessment model presented by the JTC has been thoroughly investigated through the use of sensitivity analyses conducted with the Stock Synthesis (SS) model and with the Canadian Catch-Age-Model (CCAM). It is recognized that there has been excellent and substantial work done by the joint assessment team over the past few years to explore alternative modeling software and more complex assessment scenarios. It is considered that the current approach that implements a relatively simple assessment scenario in the SS model to produce the base case, and other software, CCAM, to explore alternatives represents a pragmatic use of resources.

The estimate of the stock's recent exploitation rate is slightly above the target rate of F40%. This is principally due to the updated assessment estimating lower biomass, following higher-than-intended exploitation rates, over the past two years in particular. These estimates of current stock status and recent exploitation rates are highly uncertain. It was noted that the estimate of the abundance of the 2008 yearclass, which currently dominates the stock (and the catch in 2012), is highly uncertain.

The uncertainty in the assessment is largely driven by two processes. One is the large year-to-year fluctuations in recruitment of hake. This natural process can be monitored to a limited degree by current and improved surveys, but not controlled. The other is performance of the acoustic survey which in some years seems to not track the stock's abundance as expected. Despite extensive discussions with the JTC, acoustic survey team, and industry members at the SRG meeting, the source of these differences remains elusive. The combination of high recruitment fluctuation and high survey uncertainty means that the assessment model has insufficient information from the surveys to resolve the magnitude of new yearclasses until they have been observed for several years in the fishery and surveys. In particular, the 2009 survey made a high biomass observation

dominated by the 2005 and 2006 yearclasses. Then the 2011 survey produced a much lower biomass observation, dominated only by the three-year-old 2008 yearclass. Basically, the assessment model as parameterized cannot match the 2009 survey biomass index without estimating yearclass abundances that would persist into 2011 and cause a mismatch to the lower 2011 survey index. There is no supporting evidence of excess unaccounted mortality on these cohorts. However, it should be born in mind that future assessments could provide estimates of stock status in 2012 much different than the current estimate. Such uncertainty is the norm, not the exception.

The current default harvest policy, F40% with a down-ramp in F when biomass is below 40%, does not explicitly consider fluctuating age structure. Thus, other harvest policies may be more suitable for this stock.

The fact that the 2012 stock is dominated by one young yearclass creates substantial risk to the stock's spawning potential if this yearclass is revised downwards toward the lower end of its probability distribution, i.e. smaller than the median estimate. The SRG also emphasizes that the stock's capacity to generate large yearclasses to support a sustainable fishery is likely to be lower at low stock sizes.

Development of MSE. There are a number of reasons for using the population estimates and the assessment model as the basis for an MSE. This is primarily to investigate the current agreed harvest policy, but also to test the benefits of additional data collection. An MSE would be a highly desirable facility to use in informing management of the benefits of different approaches, both in terms of harvest strategy and the benefits and utility of data collection.

This leads to three specific studies:

1. The tradeoff in harvest under different management regimes, as the current regime has the potential to give less than maximum yield due to highly variable recruitment giving rise to low biomasses during any extended period between the high recruitment events. The evaluation of rates that would provide higher stability under the kind of variable recruitment observed.
2. The sensitivity of exploitation to additional survey data, i.e. annual/biennial surveys. An MSE could be used to explore the utility of surveys with higher frequency either with same or reduced data collection.
3. A survey with a wider transect spacing could be evaluated to see if the resources used in two years could deliver results if deployed in an annual survey.

4.5. Recommendations

4.5.1. Key Recommendations for survey data collection

The following aspects are the main recommendations taken from the discussion above:

- Extend variance estimation to cover other aspects of the survey
- Postulate/Evaluate reasons for higher than expected deviations in 2009 /2001
- Increase survey frequency to annual surveys

4.5.2. Key Recommendations for modeling

The following aspects are the main recommendations taken from the discussion above:

- Examine the model with catch estimated without error to confirm a separable model is not critical
- Develop MSE to evaluate management / survey frequency options

4.6. A brief description on panel review proceedings

I was impressed overall with the quality of this review and all who participated in it, I would like to thank all involved for their efforts. In particular I would like to thank the presenters for their clear and well prepared presentations and the chairman for his hard work guiding the review and both him and the rapporteurs for their hard work assembling and editing the Panel report.

5. Conclusion

The reports and presentations have provided an excellent basis to evaluate the performance of the assessment. The science reviewed was of a high standard and could be classed as 'of the best scientific information available'. Comments given through the report should not be read as direct criticism of what has been done, rather as ideas of areas for development. In retrospect one can always find room for improvement, and minor suggestions have been made throughout this report. The major points are presented below:

- The survey provides information that is suitable for the assessment; improvements to variance estimation are needed to increase the understanding of the survey and its utility in the assessment model.
- The assessment model has utility for management, with some minor checks on the implications of the separable assumption.

6. References

Fernandes, PG. (2009). 'Classification trees for species identification of fish-school echotraces'. ICES Journal of Marine Science, vol 66, no. 6, pp. 1073-1080.

Henderson and Horne 2007, Comparison of in-situe, ex-situe and backscatter model estimates of Pacific hake (*Merluccius productus*) target strength. Can J. Aquat. Sci. 64 1781-1794.

ICES. 2001. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, Reykjvık, April 2001. ICES CM 2001/ACFM: 17: 242 pp.

ICES. 2011. Report of the Planning Group for Herring Surveys (PGHERS), 22–26 January, 2007, Charlottenlund, Denmark. ICES Document CM 2007/LRC: 01. 187 pp.

Korneliussen, R. J., and Ona, E. 2003. Synthetic echograms generated from the relative frequency response. ICES Journal of Marine Science, 60: 636–640.

McClatchie, S., Thorne, R. E., Grimes, P., and Hanchet, S. 2000. Ground truth and target identification for fisheries acoustics. Fisheries Research, 47: 173–191.

O'Driscoll, R. L. 2003. Determining species composition in mixed-species marks: an example from the New Zealand hoki (Macruronus novaezelandiae) fishery. – ICES Journal of Marine Science, 60: 609–616.

Petitgas P., Goarant A., Masse J. and Bourriau P. 2009 Combining acoustic and CUFES data for quality control of fish stock survey estimates. ICES Journal of Marine Science, vol 66, no. 6, pp. 1384-1390.

Rivoirard, J., Simmonds, E. J., Foote, K. G., Fernandes, P., and Bez, N. 2000. Geostatistics for Estimating Fish Abundance. Blackwell Science, Oxford. 206 pp.

Røttingen, I., and Tjelmeland, S. 2003. Evaluation of the absolute levels of acoustic estimates of the 1983 year class of Norwegian spring spawning herring. ICES Journal of Marine Science, 60: 480–485.

Simmonds, E. J. 1995. Survey design and effort allocation: a synthesis of choices and decisions for an acoustic survey. North Sea herring is used as an example. ICES Document CM 1995/B: 9.

Simmonds, E. J., and MacLennan, D. N. 2005. Fisheries Acoustics: Theory and Practice, 2nd edn. Blackwell Publishing, Oxford.

Simmonds, E.J., Gutie´rrez, M., Chipollini, A., Gerlotto, F., Woillez, M., and Bertrand, A. 2009. Optimizing the design of acoustic surveys of Peruvian anchoveta. – ICES Journal of Marine Science, 66: 1341–1348.

Simard Y, Marcotte D., and Naraghi K., 2003. Three-dimensional acoustic mapping and simulation of krill distribution in the Saguenay—St. Lawrence Marine Park whale feeding ground Aquatic Living Resources 16, 3, Pages: 137-144.

Woillez, M., Rivoirard, J. & Fernandes, PG. (2009). 'Evaluating the uncertainty of abundance estimates from acoustic surveys using geostatistical simulations'. ICES Journal of Marine Science, vol 66, no. 6, pp. 1377-1383.

Zwolinski, J., Fernandes, PG., Marques, V., Stratoudakis, Y. & Fernandes, PG. (2009). 'Estimating fish abundance from acoustic surveys: calculating variance due to acoustic backscatter and length distribution error'. Canadian Journal of Fisheries and Aquatic Sciences, vol 66, no. 12, pp. 2081-2095.

Appendix 1: Bibliography of materials provided for review

Primary Documents

Draft for SRG Review: Status of the Pacific hake (Whiting) stock in U.S. and Canadian Waters in 2012. International Joint Technical Committee for Pacific hake 2/6/2012

Background documents

PROVISIONAL TERMS OF REFERENCE FOR THE JOINT TECHNICAL COMMITTEE OF THE PACIFIC HAKE/WHITING AGREEMENT BETWEEN THE GOVERNMENTS OF THE UNITED STATES OF AMERICA AND CANADA

AGREEMENT WITH CANADA ON PACIFIC HAKE/ WHITING: MESSAGE FROM THE PRESIDENT OF THE UNITED STATES TRANSMITTING AGREEMENT BETWEEN THE GOVERNMENT OF THE UNITED STATES OF AMERICA AND THE GOVERNMENT OF CANADA ON PACIFIC HAKE/WHITING (THE ''AGREEMENT''), DONE AT SEATTLE, NOVEMBER 21, 2003

Magnuson- Stevens Fishery Conservation and Management Reauthorization Act of 2006

Status of the Pacific Hake (Whiting) stock in U.S. and Canadian Waters in 2011 Joint U.S. and Canadian Hake Technical Working Group Final SAFE document 3/17/2011

Fleischer, G.W., Ressler, P.H., Thomas, R.E., de Blois, S.K., Hufnagle, L.H. and Dezhang Chu Pacific Hake Integrated Acoustic and Trawl Survey Method. NOAA Fisheries, Northwest Fisheries Science Center (NWFSC) Fishery Resource Analysis and Monitoring Division Acoustics Team February 2012

Pacific Whiting Joint U.S.-Canada STAR Panel Report Pacific Fishery Management Council Hotel Deca Seattle, Washington February 7-11, 2011

Richard D. Methot Jr. Chantell R. Wetzel Technical Description of the Stock Synthesis Assessment Program NOAA Fisheries Northwest Fisheries Science Center Seattle, WA

Appendix 2: Statement of Work

External Independent Peer Review by the Center for Independent Experts

Joint US-Canada Technical Review Panel for the Pacific Whiting Stock Assessment

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: The U.S. and Canada are in the process of implementing the U.S.-Canada Agreement on Pacific hake and Whiting, This new agreement formalizes past scientific and stock assessment collaboration through the creation of two new scientific bodies: a Joint Technical Committee, charged with producing an annual stock assessment, and a Scientific Review Group, to provide peer review of the technical committee's work. These groups will include scientists appointed by each Party, as well as independent members referred by the Advisory Panel, a panel of private sector advisors. A fourth body, the Joint Management Committee, will consider the scientific advice and recommend to the Parties each year an overall total allowable catch

Two independent reviewers, provided by the CIE, are requested to participate in the Scientific Review Group meeting. The Agreement calls for the SRG to be comprised of up to six scientific experts, with two jointly appointed by each Party (U.S. and Canada) and two independent members appointed jointly by the Parties from a list supplied by the Advisory Panel. At this point in time, not all members of the SRG committee have been formally selected or appointed by the two Parties and therefore, participation of the CIE reviewers may vary.

It is anticipated that the CIE reviewers will participate in the review panel meeting as "officially invited members" of the SRG rather than "formally appointed members", as outlined in the Pacific hake Agreement. However, it is not yet clear what their role and status at the meeting will be due to uncertainties in the international process of appointing members and crafting the SRG Terms of Reference. CIE participation in official SRG discussions and decisions will be at the discretion of the SRG co-chairs.

However, it is hoped that their roles will be no less than discussants, seated at the SRG table, if not de facto, fully functioning SRG members
The Pacific hake (or whiting, *Merluccius productus*) benchmark stock assessment will provide the basis for the management of the largest groundfish fisheries off the West Coast of the U.S. and British Columbia. For example, in 2010, Pacific whiting fishery accounted for 85% of the landed catch and 32% ex-vessel revenue of the U.S. Pacific coast groundfish fishery. The technical review will take place during a formal, public, multiple-day meeting of fishery stock assessment experts. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. One CIE reviewer shall have working knowledge and recent experience in the application of in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. One CIE reviewer shall have expertise in fisheries acoustic surveys as they apply to and are used in fishery stock assessments. Each CIE reviewer's duties shall not exceed a maximum of 16 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington during February 21-24, 2012.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and

home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate in the panel review meeting in Seattle, Washington during February 21-24, 2012.
3) In Seattle, Washington during February21-24, 2012 as specified herein, conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than March 9, 2012, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and Dr. David Die, CIE Regional Coordinator, via email to ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule. **The following dates are tentative, and the Project Contact will provide firm dates for the panel review meeting no later than August 1, 2011.**

January 2, 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
January 21, 2012	NMFS Project Contact sends the CIE Reviewers the pre-review documents
February 21-24, 2012	Each reviewer participates and conducts an independent peer review during the panel review meeting
March 9, 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
March 23, 2012	CIE submits CIE independent peer review reports to the COTR
March 30, 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on changes. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the

SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Science Director, and these reports will be made publicly available.

Support Personnel:

William Michaels, Program Manager, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

Stacey Miller
NMFS Northwest Fisheries Science Center (NWFSC)

2032 SE OSU Drive, Newport OR 97365
Stacey.Miller@noaa.gov Phone: 541-961-8475

Jim.Hastie
NMFS Northwest Fisheries Science Center (NWFSC)
2725 Montlake Blvd. E, Seattle WA 98112
Jim.Hastie@noaa.gov Phone: 206-860-3412

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference (February 6, 2012)

2012 Panel Review for US-Canada Pacific Whiting Agreement
Scientific Review Group

The SRG bases its interim terms of reference for 2012 on the language of the US-Canada Pacific Whiting Agreement, and on the Pacific Fishery Management Council's Stock Assessment and Review (STAR) terms of reference which have been the basis for Pacific whiting stock assessment review for over ten years. The SRG will revisit these terms of reference before 2013 and submit proposed revisions to the Joint Management Committee (JMC) for approval.

From the agreement language:
"*A Scientific Review Group (SRG) is hereby established to provide independent peer review of the work of the Joint Technical Committee (JTC). The SRG shall comprise up to six scientific experts, with up to two appointed by each Party and two independent members appointed jointly by the Parties from a list supplied by the Advisory Panel. All SRG members shall be different individuals than those who serve on the JTC. The Advisory Panel may also nominate, for appointment by the Parties, two public advisors to participate in SRG meetings. The public advisors shall have the right to provide their views on all aspects of the work of the SRG, both orally and in writing. The Parties shall jointly bear the travel expenses of the independent members and the public advisors for meetings of the SRG. In addition, SRG members may seek advice from others as they deem appropriate. SRG meetings shall be open to the public. The SRG shall meet annually, and more often as necessary, to:*
(a) propose its terms of reference for approval by the JMC;
(b) review the stock assessment criteria and methods and survey methodologies used by the JTC;
(c) provide, by no later than March 1 of each year, unless otherwise directed by the JMC, a written technical review of the stock assessment and its scientific advice on annual potential yield; and
(d) perform other duties and functions that may be referred to it by the JMC."

Pacific Whiting Scientific Review Group
Interim terms of reference for 2012.

1. The SRG will review the stock assessment criteria and methods and survey methodologies used by the JTC and provide a written technical review of the stock assessment and its scientific advice on annual potential yield;
2. The SRG will operate with co-chairs, one from the United States and one from the Canada, as chosen by the membership of the SRG;
3. The SRG meeting will be chaired by a SRG member. From year to year, the responsibility to chair the meeting will be shifted among SRG members at the discretion of the SRG;
4. In 2012, the SRG will be able to operate with 2 US member s and 2 Canadian members. If two independent members are appointed before the SRG meets on Feb 21, 2012, they will be treated as full members of the SRG;
5. SRG meetings will be conducted as public meetings including opportunity for public comment;
6. The SRG at its discretion will occasionally seek advice from external experts to expand its capacity to review survey and assessment methodologies;

7. The SRG will seek consensus in all matters and will document the range of discussion regarding this consensus to the extent feasible. Where full consensus cannot be reached, minority reports will be included to convey alternative viewpoints. If an issue cannot be resolved without a vote, then only full SRG members will have a vote. External experts commissioned by the SRG will be expected to fully participate in review discussions and their advice will be sought as consensus is formed; however external experts will not be voting members of the SRG.
8. All draft stock assessment and survey documents will be provided to the SRG through the JTC;
9. Material provided to the SRG through public comment will not be considered part of the technical work to be reviewed, but it may be taken into account when reviewing the work of the JTC. If public comment is directly considered in the review, both source and content of that comment will be documented in the SRG report;
10. The SRG will discuss the technical merits and deficiencies of the survey methodology, input data and analytical models during the open review panel meeting and work with the JTC to correct any deficiencies;
11. The SRG report will document relevant meeting discussions;
12. Requests to the JTC for additional analyses will be provided in writing by the SRG;
13. The SRG will work with the JTC to achieve a base case model result and to describe the uncertainty around this base case, including uncertainty represented by alternative model scenarios and uncertainty resulting from the statistical variance of the base case itself;
14. The SRG will seek a consensus position with the JTC on the recommended annual potential yield;
15. The SRG will provide recommendations to the JMC and JTC regarding issues that will need additional research before being tabled for review in subsequent years;
16. A complete SRG report will be provided to the JMC by March 1, 2012.

Annex 3: Agenda (provisional adapted in practice)
Joint US-Canada Scientific Review Group Meeting
For the Technical Peer Review of the
2012 Pacific Hake / Whiting Stock Assessment
February 21-24, 2012
Seattle, WA 98105

Tuesday, February 21, 2011

TBD a.m.	Welcome and Introductions
	Review the Status of the Pacific hake / Whiting Treaty
8:15 a.m.	Review the Meeting Agenda (Panel Chair)
	Review Terms of Reference for Assessments
	Review Meeting Assignment of reporting duties
9:00 a.m.	Data Presentations
	- Overview of the 2011 Hake/Whiting Fisheries
	o Canadian Waters
	o U.S. Waters
10:15 a.m.	Coffee Break
10: 45 a.m.	Acoustic Survey: Design and Analysis
12:00 p.m.	Lunch (on your own)
1:00 p.m.	Acoustic Survey
3:00 p.m.	Coffee Break
3:30 p.m.	Overview of the Data Sources for the 2012 Assessment
5:30 p.m.	Adjourn for the day.

Wednesday, February 22, 2012

8:00 a.m.	JTC Model Presentations
12:00 p.m.	Lunch On Your Own
1:00 p.m.	Q&A session with the JTC
	- Panel develops list of model runs / analyses for the JTC
5:30 p.m.	Adjourn for day.

Thursday, February 23, 2012

8:00 a.m.	JTC presentation(s) of requested model runs/analyses.
11:00 a.m.	Panel Discussion
12:00 p.m.	Lunch On Your Own.
1:00 p.m.	Panel discussion.
	- Identification of base model and elements for the decision table.
	- Panel develops third list of model runs for decision table and begins drafting STAR report.

Friday, February 24, 2011

9:00 a.m.	JTC presentation(s) of third set of requested model runs/analyses.
10:00 a.m.	Panel discussion.

- Discuss MCMC runs for base case model and decision table
- Panel agree to process for completing final SRG Peer Review report
- SRG finishes report

12:00 p.m. Lunch on your own

5:00 p.m. SRG Adjourn.

Appendix 3: Participants
Joint US-Canada Scientific Review Group Meeting
For the Technical Peer Review of the
2012 Pacific Hake / Whiting Stock Assessment
February 21-24, 2012
Seattle, WA 98105

Scientific Review Group (SRG) Members

Richard Methot, co-chair, NWFSC, NMFS, NOAA
Greg Workman, co-chair, PBS, DFO
Mike Prager, NMFS, NOAA, retired
Kendra Holt, PBS, DFO

Joint Technical Committee (JTC) Members

Ian Stewart, NWFSC, NMFS, NOAA
Robyn Forrest, PBS, DFO
Nathan Taylor, PBS, DFO
Chris Grandin, PBS, DFO
Allan Hicks, NWFSC, NMFS, NOAA

Pacific Hake / Whiting Acoustic Survey Team Presenters

Dezhang Chu, NWFSC, NMFS, NOAA
Rebecca Thomas, NWFSC, NMFS, NOAA

SRG Technical Advisors

John Simmonds, CIE
Henrik Sparholt, CIE
Tom Carruthers, UBC

Tuesday, February 21, 2011

TBD a.m.	Welcome and Introductions
	Review the Status of the Pacific hake / Whiting Treaty
8:15 a.m.	Review the Meeting Agenda (Panel Chair)
	Review Terms of Reference for Assessments
	Review Meeting Assignment of reporting duties
9:00 a.m.	Data Presentations

- Overview of the 2011 Hake/Whiting Fisheries
    - Canadian Waters

- U.S. Waters

10:15 a.m. Coffee Break
10: 45 a.m. Acoustic Survey: Design and Analysis
12:00 p.m. Lunch (on your own)
1:00 p.m. Acoustic Survey
3:00 p.m. Coffee Break
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5:30 p.m. Adjourn for the day.

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8:00 a.m. JTC Model Presentations
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- Panel develops list of model runs / analyses for the JTC

5:30 p.m. Adjourn for day.

Thursday, February 23, 2012
8:00 a.m. JTC presentation(s) of requested model runs/analyses.
11:00 a.m. Panel Discussion
12:00 p.m. Lunch On Your Own.
1:00 p.m. Panel discussion.
- Identification of base model and elements for the decision table.
- Panel develops third list of model runs for decision table and begins drafting STAR report.

Friday, February 24, 2011
9:00 a.m. JTC presentation(s) of third set of requested model runs/analyses.
10:00 a.m. Panel discussion.
- Discuss MCMC runs for base case model and decision table
- Panel agree to process for completing final SRG Peer Review report
- SRG finishes report

12:00 p.m. Lunch on your own
5:00 p.m. SRG Adjourn.